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STEEL CASTINGS AND THEIR USE.

Stahl und Eisen, Jan. 15. Mr. Bernard Osann, in a recent lecture before the Metallurgical Association of Upper Silesia, reviews the condition of the steel casting industry as evidenced by the Duesseldorf Exposition. The saving in weight and improvement of quality in material has been the keynote of the successful introduction of the steel casting; The reduction in weight from the standpoint of freighting in the export trade seems to be the most prominent feature German producers are concerned with, as their transportation facilities are far behind ours in point of magnitude and economy. Mr. Osann described how the conditions of the ship-building trade required results which seemed impossible, but which were ultimately attained, these remarks reminding us of the time when the stern posts, etc., of our battle ships also went to the foundries of the country. It was simply a case of compelling the manufacturer to furnish what the industry required, and he succeeded better than he thought. Mr. Osann now gives the history of the steel casting industry very briefly, the invention dating back to 1851, and being made by Jacob Mayer. The great trouble with steel castings was always in the hot and cold cracks, but the study of these phenomena finally furnished the means to overcome the difficulties. In the first place a very pure material was required, then a very quick removal of the molding sand to allow proper contraction without tearing apart the casting. Then again it is necessary to design the casting in such a way that undue straining is avoided, a point to be well thought over even for gray castings. On the whole it is better to anneal important castings on general principles, in order to overcome the tendency to crack by reason of internal strains. The temperature selected for this purpose should be between 1300° and 1500° F.. preferably an exact temperature best

found in practice and constantly checked by the Le Chatelier pyrometer. Special care must be taken to avoid shrink holes. The importance of this will be seen from the fact that a locomotive frame of about 30 feet required 32 pouring gates and risers to come out sound. An interesting method of obtaining the dimensions of the sink head for a casting is given, which shows by means of the lines of continuous setting just how large an area is required in the riser to allow liquid material to flow into what would otherwise be a shrink hole in the interior of the casting. Mr. Osann now advises the steel founder and the industrial engineer to get together more especially for electrical, mechanical and ship-building work. He advises that experiments be made on the permeability of steel castings (which are now being carried out in this country) and especially that the question of annealing castings be given more attention, which is also the case here now, as annealed castings are specified more and more in our work. A series of descriptions of special castings exhibited, as well as special kinds of steel for casting purposes, concludes the interesting article.

WASTE IN THE FOUNDRY.

The Foundry, February. In the *Mechanical World*, an English foundry foreman condemns the awful waste going on in our foundries by careless men. He describes the making of a mold and the incidental losses connected with it, such as pounds of nails, chaplete, screws, studs, and other expensive articles, all of which should be charged up to the molding cost and much of which is a dead loss by being dropped into the sand. When more are wanted for the next job a new supply is gotten from the warehouse. Then the loss of plumbago, wooden wedges, spikes, etc., all of which are dead loss. Then come the losses in other directions such as wasting fuel in drying ovens, etc., when these are not needed, not to speak of the time lost in looking for things in the scrap pile. Where loam jobs are stripped off many a good brick is split up by the laborers. Lots of good coke is lost in the cupola refuse, not to speak of the iron. So it goes all through the foundry, and it is really a wonder that some places still exist.

THE LIFE OF INGOT MOLDS.

Stahl und Eisen, March 15. Mr. P. Reusch calls attention to the injurious effect of arsenic on the life of an ingot mold. Over in Europe it seems that the Spanish and Grecian hematites used often run 1.5 per cent in arsenic. Then the blast used should not be too high in temperature, otherwise the iron is injured. The composition of an exceptionally durable ingot mold, cast of charcoal iron, is as follows: Silicon 1.27; manganese 1.29; phosphorus .147; sulphur .061; total carbon 3.87. And yet a coke iron ingot mold of this composition would not stand 10 casts. For these irons the manganese is entirely too high, and it may be added from our standard, that the silicon, sulphur and phosphorus are too high also. Mr. Reusch holds that the composition is not the only thing affecting the life of an ingot mold. The metal should be poured hot enough to avoid cold shuts; the mold and casting should be allowed to cool very slowly. To facilitate an even cooling of the ingot the inner walls of the ingot mold are often made slightly convex so that in expanding they will practically straighten out flat instead of leaving a space for the running out of some of the steel of the ingot. Then again the lower part of the ingot should be ribbed to some extent so that this portion of the mold can resist the hydrostatic pressure better. The American system of pouring ingots with the molds upon moving trains of cars is commended as vastly better than pouring in soaking pits, but still better should be the method used in Germany of taking the ingot mold after stripping and plunging into water, the idea being to cool the inside and outside quickly but evenly. Ingot molds should not only be made properly, but should also be used to the best advantage.

MELTING STEEL WITH CAST IRON.

The Iron Trade Review, March 26th, gives the paper by R. P. Cunningham, on the above subject, recently read before the New England Foundrymen's Association. He refers specially to makers of pumps, for which a high tensile strength is essential, and moreover a clean, smooth article is also required. The judicious use of steel scrap is very advantageous in the first consideration, and care in the work helps the other. Mr. Cunningham's method of charging the cupola is as follows: The bed of coke is 1200 lbs. On this comes 1000 lbs. iron, then 500 lbs. steel, 500 lbs. iron; then

200 lbs. coke, 500 lbs. steel and 1500 lbs. iron. The thinner the castings the smaller the percentage of steel allowable; in fact it is desirable to use no more steel in the mixtures than is just right for the purpose wanted, the difficulties in handling increasing greatly with the higher steel percentages used. Mr. Cunningham now describes a series of 18 heats, with percentages of steel running from 20 to 45, and the results show a very great regularity. The conclusions reached from the paper indicate that only the strictest supervision will produce uniform results in melting steel with iron in the cupola. Without this nothing of value may be expected.

MALLEABLE CASTINGS PLANT IN EUROPE.

The Iron Age of February 26 reviews a recent article by the German foundry expert, Mr. Bernard Osann, in which he describes the largest malleable casting plant in Europe, that of Gelsenkirchen. The works in question have two cupolas, each capable of making two tons per hour, from which it would seem that they are very small ones indeed, the fuel ratio being 1 to 3.9, which is about right. The charge is 71 per cent. wrought iron and steel scrap, and 29 per cent. pig iron, much of this scrap being recarbonized by the process. The castings, being small mine car wheels, are placed into cooling ovens in order not to crack, and then go into the anneal. Here they remain 21 days, or three times as long at least as in our process. As no boxes are used, but the castings go into the ovens direct with a packing of iron ore, there is lots of trouble for the employees. A series of tables showing the chemical changes completes the paper.

OVERHEAD TRAMRAIL SYSTEMS IN FOUNDRIES.

The Iron Age, January 22. At a recent meeting of the Philadelphia Foundrymen's Association, Mr. A. W. Moyer read a paper on overhead tramrail systems in shops and foundries, and went into his subject very thoroughly. These systems, which are conveying methods are great money savers, and any shop handling many small pieces daily will do well to look into them. Labor is saved, the floor space is not obstructed, and there are many exam-

ples of saving the entire cost of such a system in the first year of its installation by the economies effected. Mr. Moyer described his own system, and then showed a number of installations by lantern slides. The general opinion of the foundries where these systems are in use is that an I beam installation, no matter whose make, is the best for all-around efficiency and reliability. Patent styles of rails are not in it with the plain I beam.

GRADING AND MIXING IRON BY ANALYSIS.

The Foundry, February. Dr. Edward Kirk writes about the remarkable change from fracture grading to that by analysis, and predicts that it is only a question of time when the old style of grading and mixing will be entirely obsolete. After showing how easily the founder can get the composition of the castings he wants to make, and from this the iron he wants to buy, he warns the maker of specially good work not to rely entirely on this simple method, but to study the fine points of chemistry for the foundry so that special questions of strength, density, etc., may be solved in a proper way. Dr. Kirk is right. Only a close study, and perhaps years of it, will show just how to use pig iron properly, and the sooner methods of testing pig irons are devised which will tell us what they really are, the quicker we will arrive at methods of producing castings, the quality of which will be beyond what they are now.

CARBIDE OF SILICON FOR FOUNDRY USE.

The Iron Trade Review, March 19, goes into the use of this compound for steel works and foundries. In the former its advantages are undoubted, as it replaces ferro-silicon, which cools the metal too much unless previously melted. For foundry purposes, however, the results have so far been negative, as the metal is not hot enough to take up the silicon carbide readily. This is no reason why it should be put aside, and we hope to see more done with it, as in furnace work it would quickly give silicon, where required, without chilling the bath.

IRON IN COPPER AND ITS ALLOYS.

The Brass Founder and Finisher, December 15, quotes the article of Mr. E. S. Sperry, in *The Aluminum World*, anent the presence of iron in brass and bronze. Iron was formerly considered a very bad impurity in copper, and rightly so where it was present in mechanical mixture. Where, however, it is in a chemical combination things are different, as for instance in sterro-metal, delta-metal and manganese bronze. Here it is rather good than otherwise, though persons who have run across iron nodules in sheet brass or other classes of brass goods to the cost of spoiled tools will not take kindly to this statement. As we have no method of directy alloying iron with copper or brass it is necessary to first alloy iron with zinc or make a manganese iron alloy to put in with the copper, etc.

SKIN DRIED MOLDS.

The Foundry, February, has a short article by Mr. George Buchanan, in which he describes his experience with skin dried molds. By an accident he overcame a lot of scabbing in making condenser end covers, and as a result he continued to place a little coke fire bucket where it would do the skin drying for him. As a result of his success with this method he recommends the use of these fire buckets, which amounts to practically working with dried sand molds. The method is in effect a simple form of the coke stoves with air blast used so much in Europe for special molds where skin drying is essential.

DIPPING BRASS.

The Brass Founder & Finisher, February 15. Mr E. S. Sperry, in *The Aluminum World*, takes up the subject of dipping brasses, that is, those brasses which on being dipped for a short time in strong nitric and sulphuric acids assume an even, clean, bright, uniform surface. As to the mixture it may be said that plain copper-zinc alloys answer best, and the requirements are freedom from blow-holes, homogeneous structure. The alloy should be uniformly attacked by the acid, and castings must be free from sand and other adherent matter.

MODERN CUPOLA PRACTICE.

The Foundry, February. Mr. F. W. Stickle goes over this question at length, showing that the modern tendency is to decrease the diameter of the cupola and to raise the charging door; to have a blast belt connecting double and triple rows of tuyeres; finally, to make special internal arrangements of the tuyeres and the cupola bottom. In this way the heat of the combustion is taken advantage of while formerly it escaped at the stack without imparting heat to any series of charges above. Mr. Stickle recommends only 14 inches between cupola bottom and tuyeres, the idea being to get the iron out so fast as may be to prevent contamination by sulphur from the coke. The second row of tuyeres is a special advantage now generally recognized as giving a much more perfect combustion. The charges of iron should be the same throughout and not larger over the bed of fuel. The appearance of gases at the charging door soon indicates the condition of the cupola as well as the air supply. Care taken with the bottom will always repay itself and conditions can be regulated so nearly that 10 lbs. of coke more or less will be noticed in the results. In addition Mr. Stickle advises foundry foremen to study their cupolas continually, so that the best results in them be realized.

MOLDING FROM HALF PATTERNS.

The Foundry, March. Mr. John W. Graham describes a labor saving method of molding half patterns which, while not new, is interesting. An ordinary half pattern, say a Y or T, is laid upon a follow board which has two plates inserted to receive the flask pins. A central line is drawn on the follow board, the pattern being placed on the board guided by this line. The flask is fitted with the same plates, loose steel pins being used. When everything in ready the nowel can be rammed up and the pattern drawn. Then while it is finished the cope can be made, and thus much time saved. skeleton half patterns can be readily used, and an assortment of such specially prepared boards will prove a profitable investment in any foundry.

FUSIBLE ALLOYS.

The Brass Founder & Finisher, December 15, gives a list of

fusible alloys, of which we take a few, useful for soldering purposes as well as for delicate castings. An alloy which melts at 158° F., is made of 3 parts lead, 8 of tin, 4 of bismuth; 1 to 2 parts mercury added increases the fusibility. Newton's alloy, a standard fusible metal, is made of 8 parts bismuth, 5 of lead and 3 of tin. For delicate castings a cheap alloy is 6 of bismuth, 3 tin, and 13 lead.

ORGANIZED LABOR DECISIONS.

The Iron Age, March 5, gives an excellent summary of court decisions on disputed labor points. The article in question is by Mr. Jas. A. Miller, and is reprinted from Vol. II, No. 1, Bulletin Corporation Auxiliary Co., Cleveland, O. Mr. Miller deplores the fact that the court is not more often invoked to protect the rights of the party suffering interference at the hands of irresponsible outsiders. He states that ignorance on the part of a manufacturer of the decisions of the various courts is the reason as well as ignorance on the part of lawyers as to what constitures a labor union. Mr. Miller now explains the terms "unlawful," "common law," and "labor law." So far as the rights of the employer and employed are concerned each individual may carry on his business or give his labor as he pleases so long as he keeps within the law. Any loss occasioned to others under these circumstances cannot be recoverable. Men have a perfect right to strike provided they break no contract and aim at nothing unlawful. They may persuade men who are not under a contract and who do not object to listen to them. Picketing as it exists today is entirely unlawful. Intimidation by strikers is unlawful and can be quickly punished. The boycott and sympathetic strike are also unlawful. The methods used by unions to intimidate their members by means of fines are unlawful. The idea of injunctions is really to prevent the multiplication of court suits for each striker every week or month and an appeal can easily be taken and hardships prevented. Mr. Miller urges the formation of associations whose object shall be the settlement of legal points involved in labor troubles through the courts.

REGULATION OF CUPOLA MIXTURES.

The Iron Age, January 22. In an address before the New England Foundrymen's Association, Mr. W. J. Keep discussed the best

method of regulating mixtures for the foundry. In weighing his charges Mr. Keep prefers to begin with the high silicon pigs of the mixture and wind up with those low in that element, thus lessening the chances of error in the mixture as calculated. From his experience with the cupola Mr. Keep finds that the loss to be allowed in the melting process is 0.25 per cent. for silicon. The cupola has a tendency to increase sulphur up to .03 above that of the mixture. A series of interesting figures are given on the melting loss of various kinds of scrap as well as the method of ascertaining this. Then Mr. Keep gives the laws relating to the effect of the constituents in cast iron which are well worth repeating here.

Carbon lowers the melting point and shrinkage, and when combined hardens cast iron. Graphitic carbon is deposited between the crystals of iron after they are formed, and the decreased strength of such iron is on account of the loose grain. Silicon added to white iron turns it gray, by changing combined carbon into graphite. As silicon is the only element which it is practical for the founder to use for this purpose and to decrease shrinkage, it is the controlling element. Phosphorus does not influence carbon, but reduces strength more than and other element. Sulphur is always present, but is of no benefit. It is sometimes freely absorbed by melted iron, and at other times, when the conditions seem the same, it will not do so.

Manganese hardens castings. Sometimes it combines with sulphur and enters the slag, but if manganese and sulphur both remain in the iron, the manganese does not counteract the influence of the sulphur.

FOUNDRY DEVELOPMENT IN ENGLAND.

Eisen-Zeitung, No. 8. A good deal has been done in England recently to improve the foundries there, and this may be traced directly to the effect of America desiring to build up an export business there, notably the Westinghouse Electric Co., and the manufacturers of cupolas and molding machines. Especially in the application of the molding machine do we see a marked improvement, as this means much for the future status of their export trade. In addition to the above the matters of heating and ventilating are also

looked into more, and conveying apparatus finds a more ready application. Taken all in all the movement seems to date from the advent of American methods, brought there by our representatives and taken back by English visitors here.

STANDARD PIPES AND SPECIAL CASTINGS.

The Engineering Record, January 17, in an editorial on the above subject discusses the recent standards presented to the New England Water Works Association by its committee. These have been mentioned in our "Reviews" before, but attention is again called to this work, as it includes standards for straight pipes not only, but for special castings, such as curves, various kinds of branches, reducers, sleeves, caps, etc. The economy and convenience which results from a good set of standards cannot be overestimated, but the interesting point to the foundryman lies in the fact that with these standards in general use it is possibls for him to keep a small stock always on hand for the convenience of the municipality, etc. This really means that he can fill up odd days with this work when other orders are coming in slow.

CAST IRON SECTIONAL STEAM BOILERS.

The Engineering Record, January 24. Mr. J. J. Blackmore recently read a paper before the American Society of Heating and Ventilating Engineers, in which he advocates a proper rating of cast iron sectional boilers. It is well known that for heating purposes this type of boiler has no equal, for which we foundrymen are truly grateful. With proper rules for figuring out the effective heating surface Mr. Blackmore thinks one of the great difficulties of the designers of buildings in which these boilers are used will be removed. He is right in this, and his methods proposed deserve the full attention of those of our foundrymen interested.

STREAKS ON CHILLED SURFACES.

Iron Molders' Journal. In order to keep chilled surfaces from

streaking it is neeessary to pour the mold as quickly as possible, a point always made in a car wheel foundry. Dull iron and too heavy a chill are apt to leave scars on the chilled face of the casting. To prevent chills from sticking use ordinary pattern makers' shellac, having the chills warm before the application. By coating a warm chill there is no dampness to contend with afterwards. Big gates, hot iron and a quick pour will do the trick.

ANNEALING WHITE CASTINGS.

American Manufacturer describes another quick anneal process gotten out by our old friend Dr. Hunter, who has experimented long on lines intended to shorten the annealing process for malleable castings. This time he uses nitric and sulphuric acid gases. He takes care, however, to raise the heat very high, and suggests that "if you don't at first succeed, try, try again." As a matter of fact the whole annealing process depends upon the heat treatment the castings are subjected to, and not upon the packing or atmospheres introduced. With castings of the proper composition and with the right degree of heat applied, the packing or lack of packing material is not essential, as it is just as easy to anneal in fireclay as it is in "scale".

LIMITATION OF OUTPUT.

The Foundry. The recent deliberations of the National Founders' Association are reviewed by Mr. Jas. A. Murphy, who dwells specially upon the restriction of output practised by the molders' unions. Whatever may be the method used, the interference of one man with another regarding the amount of work he puts up is intolerable and forms the most serious complaint of the founder today. Good wages and the best of working conditions we all want to see, but the unwarranted intrusion into the rights of others must be stopped. Molders are becoming more liberal in their views regarding the output, but the floating element holds fast to the old and unjust custom. Mr. Murphy asks that the local unions be made to embody in their charter a clause forbidding any interference with the day's output, on penalty of its forfeiture. He cites an example

of restriction of work such as we all have gone through, and gives his method of overcoming the particular difficulties. The minimum wage rate also comes in for heavy scoring, and deservedly so, Mr. Murphy holding that 90 per cent. of the ordinary molders are not worth their shop room on first-class work, and these are the men who sputter most about "union principles." Many a molder is worth twice the minimum rate. and many more only half of it, while many foundries are watching every chance to take advantage of the men employed, on technicalities, so also are many men doing this with their employers. The golden rule is just as good in the foundry as elsewhere.

STEEL FOUNDRIES IN THE U. S. AND CANADA.

The Iron Trade Review, February 26, gives a list of all the steel foundries in this country, from which the following may be noted. There are 85 plants in operation, or nearly as many as in the "malleable" business, the output of castings being considerably less, or a little over 300,000 tons per annum. 57 foundries are using the open hearth method, 11 the Bessemer, and 10 the crucible. 7 foundries make steel castings by other special processes which it would be interesting to know as a bit of metallurgical news. Six other steel foundries are projected.

RATING PRESSURE BLOWERS.

The Iron Trade Review, March 5, gives the paper of Mr. G. C. Hicks, Jr., on the above subject, which was recently read before the Pittsburg Foundrymen's Association. After giving some interesting history in relation to the original conception of the idea and its application to the melting of iron, Mr. Hicks describes the blower in detail. The impellers are not run in actual contact, but have a clearance of less than 1-64". This clearance is afterward taken up with a grease which makes a tighter joint, the actual loss of air being between 6 per cent. and 10 per cent. As the friction is practically a constant quantity the loss of work through it becomes smaller as the pressure increases, hence it is more economical to use

a blower at high pressure than a fan. This point of economy lies between 7 and 9 ounces. Mr. Hicks now enlarges on the advantage of a vibratory blast pressure to help otherwise disadvantageous piping requirements. The total efficiency of the rotary pressure blower installation is 73 to 75 per cent. Where a very high pressure is used, as in smelting works, 90 per cent. efficiency is often met with, and only 7 per cent. air lost. Mr. Hicks finally advises ample blower capacity for the cupola and ample power for the blower.

SPECIFICATIONS FOR COKE, IRON AND SAND.

Engineering Magazine, March, 1903. After some general remarks on the advantages of buying by specification, Mr. Robert Buchanan takes up the purchase of pig iron and shows that he still has some of the old fracture methods clinging to him. Perhaps this may account for the rather unfavorable results our American foundrymen have had with their recent purchases of pig iron from England, while those from Germany, where the correct composition was available, were perfectly satisfactory. Mr. Buchanan, however is desirous of having analyses accompanying offers of iron, and we hope he will succeed in getting the American method of buying pig iron adopted over there too, for the benefit of the foundry industry. It took us long enough over here to arrive at this point. The sand allowance of 28 lbs. per ton seems to cut somewhat of a figure over in England, its allowance or refusal having a direct bearing on the sale. Scrap and coke specifications are next taken up, and we are envious to note that England can specify low sulphur coke, while over here we must take what we can get at present. Fluxes, refractories, facing, etc., are finally taken up; the special brands discussed being local, would not affect us over here, especially as we rather prefer to buy our supplies in these lines direct from the best makers.

MOLDING BY HAND AND MACHINE.

Engineering Magazine, February. Mr. R. Buchanan continues his articles on foundry management in the new century. These

articles recapitulate the methods we are well acquainted with and need therefore to be but briefly reviewed. Under molding by hand we have the "bedding in" process, which is more expensive but saves flasks. Where flasks are used they should be as much as possible of an interchangeable nature, so that the supply of sides, ends, pins, etc., may be limited in sizes. A number of illustrations are given showing a very good interchangeable flask. Further information is given on small iron flasks. We, over here, prefer the snap flask for "repeat" work, and Mr. Buchanan says that the use of this method is not too prevalent in England, and should be studied by English foundrymen. He therefore goes into the question at length. Hand presses, or, as we call them, "squeezers," come in for some explanation next. Then methods for grinding "facing" are discussed, we, over here, preferring to buy this material from reliable makers. The mixing of facing and molding sands seems to be done over in England as it is here.

RECOVERING IRON FROM CINDERS.

The Foundry, April. Mr. W. J. Keep describes his method of recovering the shot and iron from the cupola dump. We give it in his own words:

"After the blast has been shut off and all of the melted iron has been drained from the cupola, make a dam on the floor in front of the cupola spout, about 4 inches high, enclosing a semi-circular space having a radius of about 4 feet. Let the melter lay a tapping bar across the spout and have three or four laborers, with a piece of old 1½-inch shafting about 8 feet long, ram in the breast. If the bottom and spout have been made right there will be no melted iron in the cupola, but run the ram back and forth to allow all to drain out. All of the liquid slag in the cupola will run into the enclosed space underneath the cupola spout and if there is any iron among this it will run through the slag and lie on the floor in the form of a slab which can be picked up the next morning. When the cupola has been emptied of all slag and iron, drop the bottom. I like to draw the refuse out from underneath the cupola, turning it over and cooling it down with water.

"The next morning, there being no slag in the dump, the coke

can be readily picked out and returned to the charging platform, to be used as the melter chooses, as it has been weighed once and charged to the melting of the previous day. The pieces of the cupola sand bottom are thrown to one side and all the iron that can be seen is picked up. All iron taken from the cupola dump, the pig bed or from the gangway, which is not bad castings, is weighed up and charged as remelt or home scrap. All remaining small pieces of coke, iron or slag are shoveled up from the bottom and from all parts of the foundry and placed in boxes on the cupola platform. This includes skulls from the ladles which contain more or less iron.

"When the last charge of iron has been placed in the cupola and the heat is near enough to the end to show that there will be no shortage of iron, throw into the cupola any shot iron that may be left over and all the refuse previously mentioned. The iron and slag will all be melted at once and the small bits of coke will hold the blast down and insure hot iron.

"All the finest shot iron is in this way saved, as well as all coke in the form of small pieces, and nothing is lost. There is no increased expense of handling, since the absence of slag gives less work in picking over the cupola dump; all the necessary labor connected with the cinder mill as well as the power to run it and general wear and tear is avoided. I have never used a magnetic separator, but I understand that after the cinders have been crushed they are run over a four or six-mesh screen to remove the sand and fine material before this reaches the magnetized portion of the machine. It is the fine particles that would pass through this screen, as well as all the balance, that my method will save."

GATES AND SPRUES.

The Iron Trade Review, February 5. Mr. D. B. Fuller recently read a paper before the Pittsburg Foundrymen's Association on proper methods of gating up. The first thing done in the foundry when a pattern comes in is to determine how to gate it up, and Mr. Fuller gives several examples how not to do it, as well as the methods which give the best results. Here are a few illustrations:

"I have in mind a pattern for a coping used to cap off a stone

wall. This pattern was shaped like the side and top or roof of a wall-tent. It was not feasable to force all the iron from the bottom gate, the casting being very light, and from its shape the consequent strain upon the mold was very great, to say nothing of the difficulty of running when thus gated. At the first line of parting, or at the bottom of the roof slope, was a sharp beading of sand running the full length of the pattern, which made this undesirable as a place of gating, as the iron striking this beading caused washing or cutting away of the sand. Along the highest point, or as I might say for illustration, the peak of the roof, were cast in a row of wrought iron spikes in such a manner as to prevent the placing of "pop gates," or top pouring gates. The mold was made in three parts, the cope line being about 4 inches below the highest point of pattern, on this parting the gate was cut.

"The casting being poured double, a runner was cut the full length on either side, and about 6 inches back from the pattern, sprues were cut from these runners to the casting, about 3 inches apart. Now what I wish to illustrate is this: The molder cut the sprues deeper at the back, or where the iron was to leave the runner, than where they connected with the casting, thereby causing the metal to choke at the point where the mold was least able to resist the pressure, for owing to the shape of the pattern, there was very little support underneath the gate. When the mold was poured, the pressure coming upon this weak point, caused the breaking down of the gate and loss of the casting. This trouble was entirely obviated by reversing the shape of the sprues, cutting them smaller at the back, gradually widening and deepening towards the casting, with a slight dove-tail at the finish, this keeping the pressure back in the runner and allowing a free and yet gentle flow of iron to enter the mold. No further trouble was experienced from gates breaking down.

"As another example, take what is known as the end bracket for brushless motors. It is a circular casting 6 feet outside diameter, having heavy hubs in the center, in which are the bearings for the armature shaft. Around the outer rim are bosses, where the bracket is bolted to the field casting, while the part between the rim and hub is principally composed of light checker work or grating, so made for the purpose of ventilation. In gating this upon the rim, the iron must flow first down and inward to the center; and

while the heavy hub is filling, the metal is slowly moving upward and outward amongst the grating. Thus cold seams are formed. But if what is known as horn gates are used, reaching from outside the circumference of the pattern underneath to the hub, thus filling the heavy center first, the balance of the mold is filled rapidly and cold seams avoided.

"Many and various forms of gates are used in the foundry, each with its specific use—the flat gate, the horn gate, the skimming gate, etc. As to the skimming gate, the old fashioned No. 6, when properly used, is reliable. In using this the sprue should be cut at such an angle that the iron, in the swirling motion, will pass the sprue, carrying the dirt and dross with it, and lifting it up into the head placed to receive it. This represents the principle used in casting rolls, where the gates are so placed as to cause the iron to form a whirlpool in the mold, thus carrying the dross to the center, and allowing it to rise up in the sinking head on top of the mold.

"Another excellent form is the tea-pot gate, where the metal must find its way down through the basin of the gate and thence upward through the spout to the sprue, allowing the dirt to remain in the top of the reservoir. The uses of the horn gate are manifold, but one example will suffice, that of the armature bushing. It is not good practice to pour this from the top, owing to the sharp bed of sand on which the iron would beat, this causing it to cut or wash away; but by filling the mold from the rim with the aid of the horn gate this is prevented.

EMPLOYER AND EMPLOYEE.

The Iron Age, March 19. Mr. W. H. Pfahler, the father of the movement to bring foundrymen and molders together, writes interestingly in the Bulletin of the National Trade Association on the question of conference and conciliation in labor matters. We append his conclusions, as well thought out :

1. That labor organizations are the natural result of a great movement in the business world which is replacing costly competition with profitable co-operation, and are formed primarily for the protection of their members, upon the theory that collective bar-

gaining for the sale of their labor is more profitable than individual contract.

2. The accomplishment of their object requires labor organizations to secure the membership of the largest number of persons employed in any kindred trade, and (because voluntary advancement of wages rarely or never occurs) to demand a change in wages and betterment of conditions whenever it appears that the need for their labor is in excess of the supply, and therefore warrants such demand. Labor organizations are necessary also to resist collectively any movement on the part of the employer which would result in injury to the workingman.

3. Whenever labor organizations by reason of false leaders have made unfair demands or established conditions which were unfair to the employer, it has been because of the use of collective force against the individual employer, and this has been defeated whenever the employers have organized similar associations for their own defense.

4. That strikes for advancement in wages and improvement of condition—occurring, as they do, during a period of prosperity—usually succeed, while strikes for recognition of the union, usurpation of the rights of the employer or against the reduction of wages almost invariably fail in their purpose.

FOUNDRY RIGS.

The Foundry, April. The subject of rigs as a factor in the foundry is handled by Dr. Edward Kirk in an able article. Patterns are taken up first and metal ones are called for wherever possible, as preferable. They should be properly drafted to mold to the best advantage. Flasks should not be too large, just large enough being right. An excess of space to fill up with sand means time, and therefore money uselessly expended. Where there are proper foundry rigs in existence for handling flasks, etc., work may be done to such advantage that the loss of one shop means the profit of another. Dr. Kirk gives several instances of this, which show that good rigs are a paying investment. As a general proposition, special rigs pay, for if they are not provided the work must be done with higher priced men, and it takes more time in addition. So far as the pattern is concerned even relatively small orders should

allow them to be placed on the follow board—the time otherwise spent in making the partings soon paying for this. Dr. Kirk suggests the placing of a rig-foreman in large foundries as a paying proposition. He further advises that the molders who get up good rigs should be compensated for their ideas as an encouragement for turning out more work in a given time than would otherwise be the case.

THE MALLEABLE INDUSTRY OF AMERICA.

The Iron Trade Review, April 2, goes into statistics in connection with the malleable business, giving the plants of the United States and Canada, together with the tonnage equipped for, and also the plants projected. From the list we find that Illinois heads the list with 20 plants; Pennsylvania, Ohio, and New York following in the order named. There are 123 works, and the daily capacity is 3,052 tons, but this is not the output. While these capacities mean an annual output of some 900,000 tons, the actual amount will probably not exceed 750,000 tons, which in itself is enormous, as the combined output of the rest of the world is probably not over 50,000 tons per annum.

CUPOLA PRACTICE.

Engineering Magazine, April. Mr. Robert Buchanan continues his able articles on foundry management in the new century. The Cupola forms the subject of his present article. The tuyere arrangement will depend largely upon the class of castings to be made. With light castings they must be low, but the slag must be readily removable. For heavy work the tuyeres should be high enough up to allow plenty of iron to collect before tapping. The English method of using the fore-hearth is commended by Mr. Buchanan where the best mixing effect is desired. He admits, however, that there is a loss of economy where this is done. Over here we prefer to mix the charges properly in the first place and do the rest in a good large bull-ladle. In Great Britain they seem to use the solid bottom cupola universally, while here we seldom see this system. Mr. Buchanan recommends our system as the most

advantageous in the long run. On cupola linings we have still much to learn, the basic lining being worthless to us, but the acid, or fire brick lining leaving much to be desired also. The question of mixing by analysis now is discussed, Mr. Buchanan giving the limits of the elements for various classes of work. Good hot iron is a desideratum as it leaves the slag very hot also and this takes up much of the sulphur of the coke, which means comparatively better castings. Double rows of tuyeres are recommended, and properly so. A few points relative to lighting up the cupola follow. The fallacy of using high silicon irons with heavy proportions of scrap is gone into, the carbon being so reduced that excessive contraction results. Prof. Turner's discovery of the action of silicon on the carbon present is then commented upon, for this is or should be universally known to be the real starting point of the wonderful improvement of the foundry industry, so far as the material is concerned. The use of steel in the mixtures gets a few words of explanation, and then fluxes are taken up. Limestone naturally forms the standard flux; fluor spar has so far not been able to replace it. Really the only special advantage of account with this material is the remarkable fluidity given the slag. The melting loss is naturally a function of the scrap used. Then also the blast has much to do with it. It is a good thing to look into the slag for undue amounts of oxide of iron, as this shows up the working of the cupola. If the quantity exceeds 10 per cent. there is something wrong with the process. Overhead and track ladles are next discussed for the conveying of iron, and Mr. Buchanan finally deprecates the recovery of shot iron. If the recent figures of Mr. Putnam are of any value, there is at least a question for study in this.

EMPLOYERS' ASSOCIATIONS.

The Iron Age, April 9, in an editorial comments upon the recent growth of Employer's Associations. The movement was slow in getting under way, but the conditions in the labor market necessitates this action more and more. The systematic aggression of organized labor, which, though embracing only a small part of labor in general, yet assumes to be its sole representative everywhere, owes its strength to excellent organization and amalgamation of inter-

ests. This is now so serious that, the government being unable to deal with it, capital is commencing to take a hand in the matter to save itself and the people at large from untold tyranny. This movement is proceeding on two lines. One is the formation of Associations representing one trade or line of trade only, such as the National Founder's Association, which originated in our own body. The other way is in the direction of bringing together the employers of a given city or locality, such as Cincinnati, Dayton, Chicago, etc. Dayton is a conspicuous example of what can be done in a union ridden town. While formerly at the point of industrial ruin, the employers' association, after a sharp conflict, has destroyed this influence and Americanism rules today, and not trade unionism. In conclusion, attention is called to the fact that now is the time for closer union of employers for the purpose of resisting the encroachments of organized labor.

MOLDING SAND.

The Iron Trade Review, April 16. Mr. F. E. Gordon read a paper before the Pittsburg Foundrymen's Association on the above subject, on April 6th. Albany and Jersey sand has always enjoyed the confidence of foundrymen, whenever selected by experienced men. About 900,000 tons are shipped from the Albany district annually, which goes to show that much sand sold in the last 50 years, as coming from there, the vein being but 2 feet thick at best, must have been spurious. The next territory in age and reputation is that of Conneaut and Kingsville. Next comes the Sandusky territory, the sand from which is not so reliable as it is not handled systematically. The Pittsburg markets take much of the Zanesville sands as this seems to answer peculiarly well for heavy work. Mr. Gordon rightly holds that great care should be exercised in the selection of the sand as no factor costs so little yet has so far reaching effect as this. 5 cents more spent in sand is often more potent than $1.00 extra on the pig iron. The time spent by the laborer in mixing the sand, the size of the scrap heap, the appearance of the castings; all these factors combined, should be looked into when studying the sand question. Mr. Gordon concludes with this :

"The man who places his order early in the season for ship-

ment at regular intervals, as his wants may require, and counts on getting his winter's supply during July, August and September, and from that time on until the end of the season, and replaces, until the season closes, such as may be consumed, can afford to pay 10 per cent. for the money used and will be the sand man's best friend."

FOUNDRY ACCOUNTING.

The Iron Age, April 16. A very able paper on Foundry Accounting and method of estimating costs of casting was read by Mr. O. C. Barrows, a trained accountant, before the New England Foundrymen's Association on April 8th. The article has a number of tables and etchings of forms used and the interested reader will do well to study the article itself to get the value it contains. One point, however, is added in the concluding remarks of Mr. Barrows, and is given herewith. "If some such basis of estimating and keeping cost in neighboring foundries were in vogue in all, might there not be better results, prices better regulated, less friction between customer and seller? In every case the foundryman would feel that he was meeting fair competition, and that his success would demand the best facilities, best apparatus, best help, modern appliances, and close attention to details, while the figures kept and shown as indicated would prove and confirm from week to week the results of his efforts."

That is why we should like to see a section for Foundry Accountants established in our Association. With proper standard methods we might do away with many unnecessary losses in our business.

THE GRADING OF PIG IRON.

Engineering Magazine, April. In an editorial the above subject is taken up as a very timely one. To quote from the article, "The question of the strength and suitability of materials of engineering construction is being studied more and more, and the present tendency is to carry the practical investigation of materials back several stages beyond the state in which they enter into the completed structure. Thus the properties of the group of materials known under the gen-

eric name of steel have been traced back to the constituents of the pig iron, the furnace lining, the materials added in the converter or open-hearth furnace, the heat treatment, and other elements in its preparation and manufacture. In like manner the nature of cast-iron products is held to be largely dependent upon the character of the pig iron fed into the cupola, and this again upon the character of the ore, flux, and fuel delivered to the blast furnace. It has well been said that the raw material of one industry is the finished product of the other, and thus no product is entitled to be called raw from the moment that the hand of man has been laid upon it to apply it to any useful purpose.

"The extensive use of cast iron in all departments of engineering work renders it especially important that definite results should be attained within reasonable limits concerning the strength and character of the products of the foundry cupola, and hence the necessity of grading the pig iron which forms the principal supply of material for the cupola has long been appreciated. The old method, that of grading pig iron by fracture, has been found unreliable, since the appearance of the fractured end of the pig is now known to be dependant upon the rate of cooling and other considerations besides quality and composition, and hence various methods have been suggested to permit a more accurate knowledge to be obtained."

This is quite to the point, and shows our foundrymen how the users of castings feel on the subject. The article now goes into the two recent papers on the subject written by your Secretary, quoting the salient points and calling attention to the present state of the matter, as one which should be supplemented by further study for the benefit of the industries of the country.

COLORING BRASS BLACK.

The Iron Age, April 16. The beautiful black finish now produced on brass is a rather difficult tint to obtain, and this seems strange as brass left in the open gradually acquires a black tint from simple oxidation. An article in the *Metal Industry* goes into the matter at length, and it is said that the best method in use today is the immersion in a solution of carbonate of copper in ammonia.

The carbonate of copper is best bought in a plastic state, though directions are given to make it from the sulphate if desired. One pound of the plastic copper dissolved in two gallons of ammonia gives the required strength. First boil the brass in a strong potash solution to remove all grease, then immerse in the copper solution which has been previously heated up to 150° to 175° F., between which temperatures it works best. Leave in the solution until the required tint is obtained. Now rinse and dry in sawdust. The finish of the brass before tinting has an effect upon the final appearance. The red metals give the best results, the predominance of copper assisting in this. Where very yellow brasses are used it often pays to electroplate them with copper first.

THE STATE AS A PIPE FOUNDER.

The Ironmonger, April 11, in an editorial describes the situation in Australia where the government owns a large pipe foundry. Recently a large contract for cast iron pipe was to be given out for public improvement and the government bid in competition with those of a number of importers was so low that considerable comment was created. The Manager, however, claimed that his estimates were correct, and the contract was given the State. It goes to show that it is cheaper to import pig iron and fuel into Australia, than to import the pipe, and perhaps this will hold good in the future in other foreign markets.